N00236.001314
ALAMEDA POINT
SSIC NO. 5090.3

5070
Ser 1831/L6186
May 10, 1996

Mr. Thomas P. Lanphar
Project Manager, Base Closure Branch
Department of Toxic Substances Control, Region 2
700 Heinz Avenue, Suite 200
Berkeley, California 94710-2737

Dear Mr. Lanphar:

This letter is provided in response to comments received from the Department of Toxic Substances Control (DTSC) on March 1, 1996, and a follow-up conference call on April 9, 1996, regarding the proposed background data set for Naval Air Station (NAS) Alameda. Participants on the conference call included Teresa Bernhard, Navy; Theresa Lopez, PRC Environmental Management, Inc.; Jim Polisini, DTSC; and Sophia Serda, U. S. Environmental Protection Agency, Region 9.

The Navy provided the requested cumulative frequency plots of log-transformed data for arsenic, beryllium, cadmium, mercury, and lead to DTSC on March 5, 1996. Duplicates of the revised plots are provided in enclosure (1). Two sets of cumulative frequency plots were created: one set contained only the detected concentrations for each analyte, and the second set contained both detected and non-detected results. Non detect values were set at equal to one-half the sample quantitation limit. The data set used included all soil samples from 0 to 10 feet below the ground surface. No samples were eliminated as outliers, although samples collected from sewers or manholes, as well as trip blanks, method blanks, and other quality control samples were excluded.

During the conference call on April 9, 1996, Dr. Polisini and Dr. Serda requested: cumulative frequency plots of log-transformed data; electronic copies of all inorganic analytes in the comprehensive RI data set; and descriptive summary statistics for all inorganic analytes using the comprehensive RI data set. Electronic copies enclosure (2) of the data sets are provided so that the agencies can prepare the requested cumulative frequency plots for the additional inorganic chemicals.

The Navy is providing a revised combined data summary of the Site 1 Enclosure (3), College of Alameda, and EBS data set to include the coefficient of variation and correct typographical errors found in the original Table 3 submitted in February. Enclosure (3) provides a more comprehensive response to comments based upon clarification received during the conference call and information pertaining to follow-on efforts.

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The Navy is continuing to evaluate the use of these data sets as background samples. Should you have any questions regarding this matter, please feel free to contact Ms. Camille Garibaldi at 415-244-2516 or FAX at 415-244-2654.

Sincerely,

M. L. PETOUHOFF, LCDR, CEC, USN
BRAC Environmental Coordinator
By direction of
the Commanding Officer

Enclosuress:
(1) Cumulative Frequency Plots
(2) Electronic RI Data Sets
(3) Response to comments and follow-on information Proposed Background Data Set for Naval Air Station, Alameda (with Attachment A - Power of the Test Equation))

Distribution:
California Department of Toxic Substances Control (Attn: Jim Polisini) (Encls. (1), (2) & (3))
U.S. Environmental Protection Agency (Attn: Sophia Serda) (Encls. (1) & (3))

Copies w/out enclosure (2) to:
PRC Environmental Management, Inc. (Attn: Duane Balch)
PRC Environmental Management, Inc. (Attn: Theresa Lopez)
SOUTHWESTNAVFACENGCOM (Attn: Dennis Askvig, 1852.DA)
California Department of Toxic Substances Control (Attn: Tom Lanphar)
U.S. Environmental Protection Agency (Attn: James Ricks)
U.S. Environmental Protection Agency (Attn: Dr. Barbara Smith)

Blind copies to:
183, 1831, 1831.1, 1832.2, 1831.3, 1831.4, 1812, Steve Edde (BEC)
Info. Repository (3 copies)
Chron, Green
Activity Files: NAS Alameda (File: L6186CG.DOC) ab

FIGURE 1A
CUMULATIVE PROBABILITY PLOT FOR ARSENIC
SITE 1, COLLEGE OF ALAMEDA, AND EBS SAMPLES

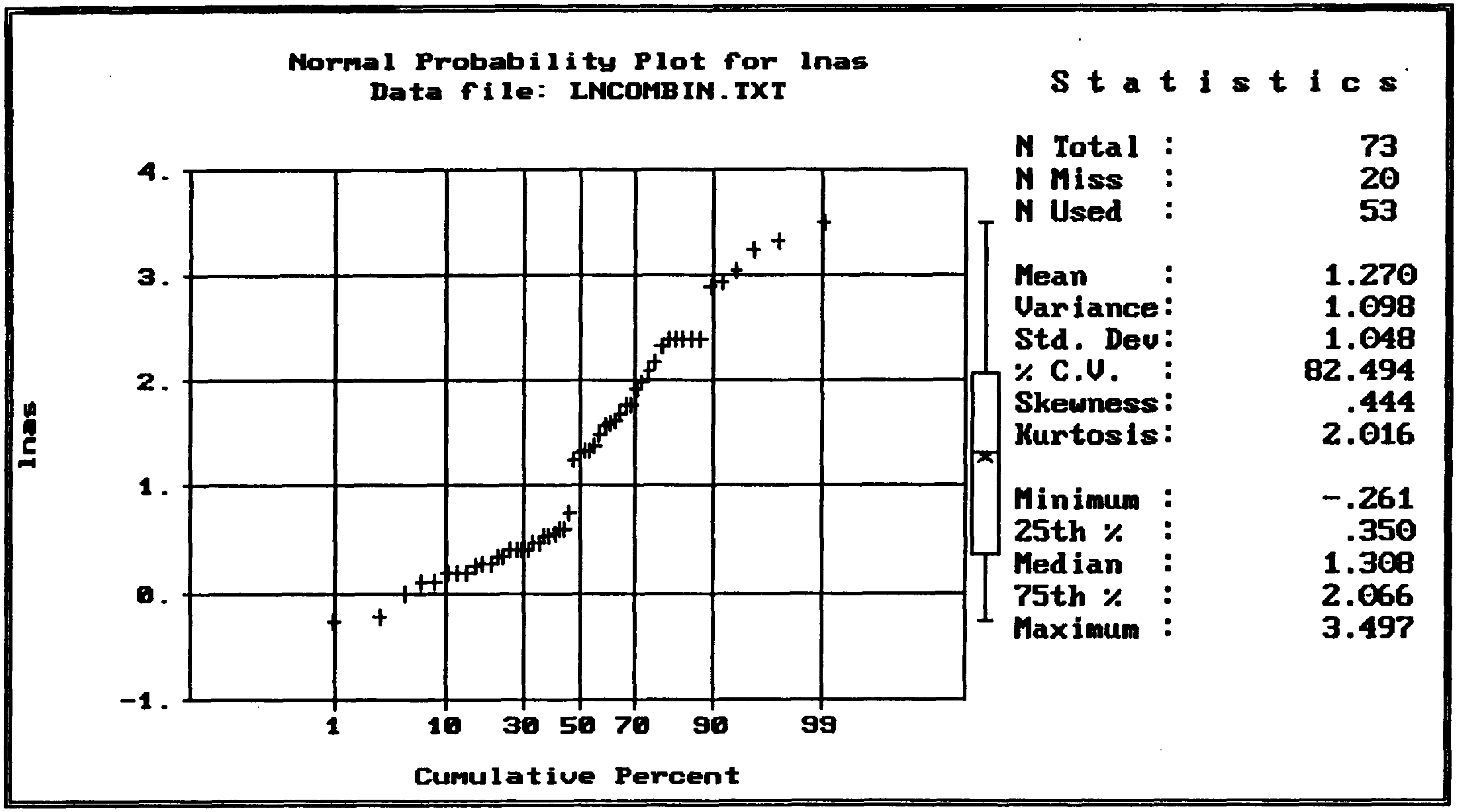


FIGURE 1B
CUMULATIVE PROBABILITY PLOT FOR BERYLLIUM
SITE 1, COLLEGE OF ALAMEDA, AND EBS SAMPLES

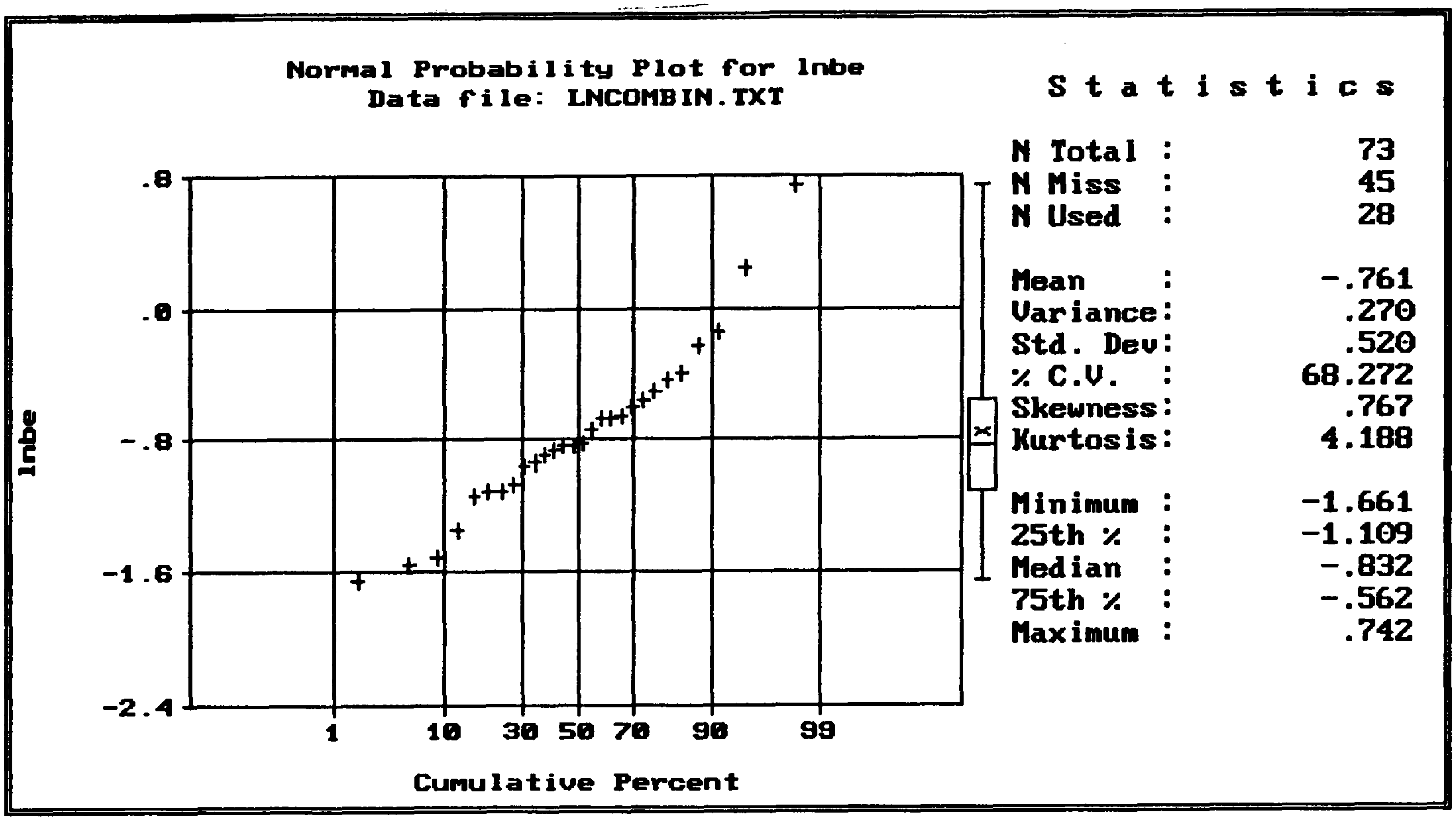


FIGURE 1C
CUMULATIVE PROBABILITY PLOT FOR CHROMIUM
SITE 1, COLLEGE OF ALAMEDA, AND EBS SAMPLES

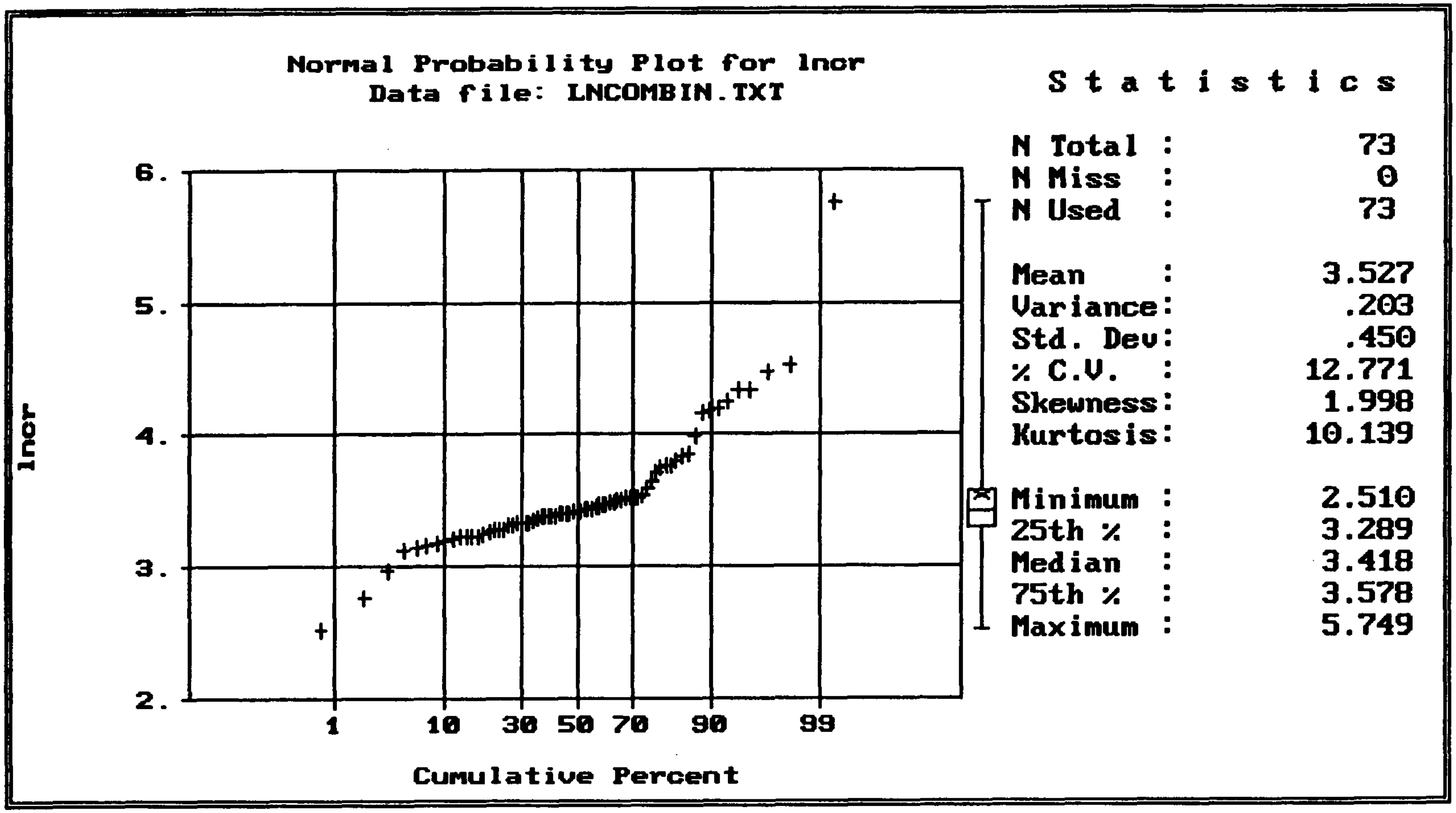
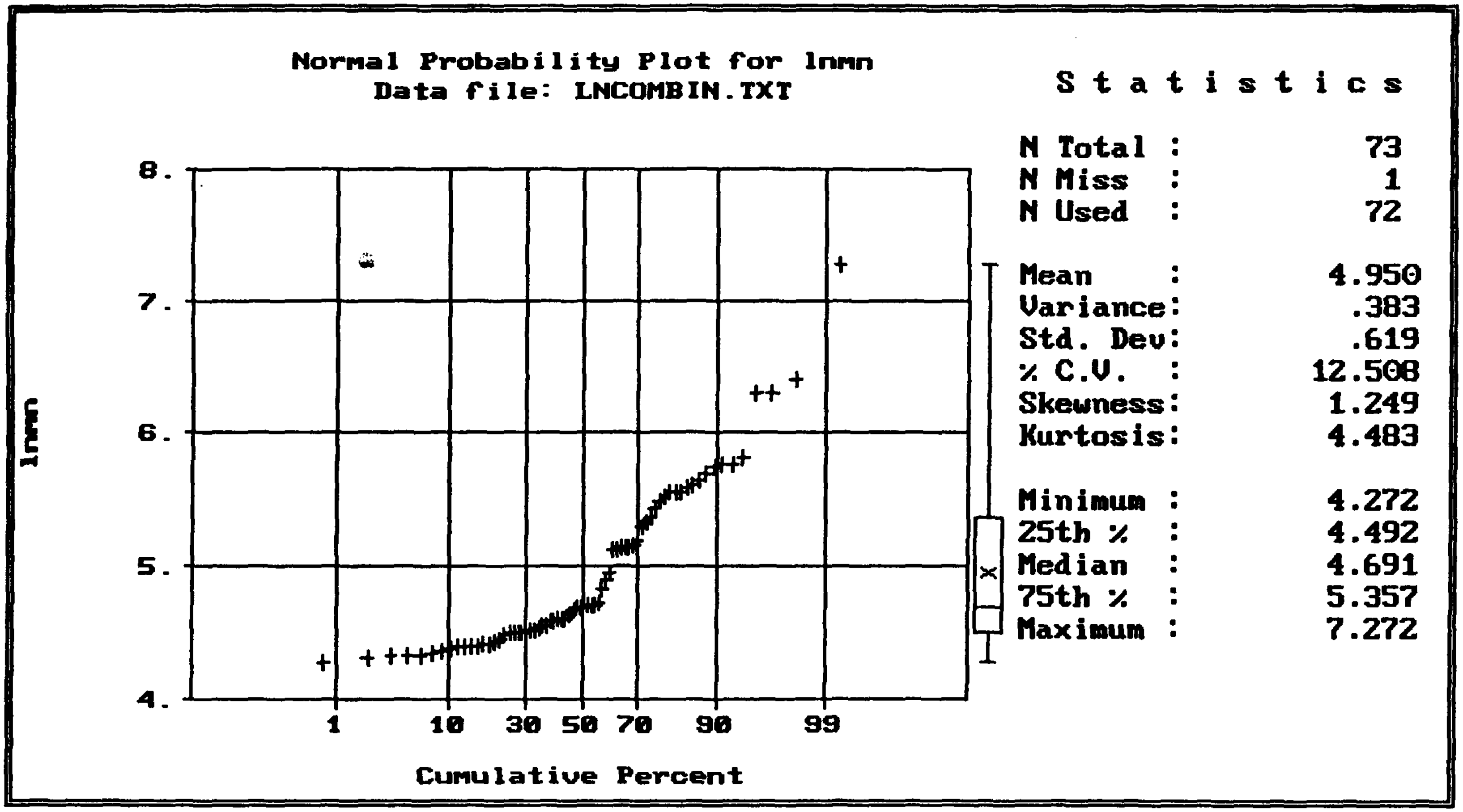


FIGURE 1D
CUMULATIVE PROBABILITY PLOT FOR MANGANESE
SITE 1, COLLEGE OF ALAMEDA, AND EBS SAMPLES



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ENCLOSURE 2

ELECTRONIC RI DATA SETS

THE ABOVE IDENTIFIED ENCLOSURE IS NOT AVAILABLE.

EXTENSIVE RESEARCH WAS PERFORMED BY NAVFAC SOUTHWEST TO LOCATE THIS ENCLOSURE. THIS PAGE HAS BEEN INSERTED AS A PLACEHOLDER AND WILL BE REPLACED SHOULD THE MISSING ITEM BE LOCATED.

QUESTIONS MAY BE DIRECTED TO:

DIANE C. SILVA
RECORDS MANAGEMENT SPECIALIST
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 532-3676

ENCLOSURE (3)
RESPONSE TO COMMENTS AND FOLLOW-ON INFORMATION
PROPOSED BACKGROUND DATA SET FOR
NAVAL AIR STATION ALAMEDA

note: italicized comments are efforts which followed the April 9, 1996 conference call.

The following is provided as a response to comments provided by DTSC on March 1, 1996 and follow on information concerning the proposed background data set for Naval Air Station (NAS) Alameda. The responses are confirmation of clarifications and discussions that occurred on April 9, 1996.

A general comment by DTSC stated that additional materials would be required by DTSC prior to commenting or approving the proposed background data set. This comment did not require discussion; the comment is noted.

Specific Comments

The first specific comment 1 stated that inorganic concentrations were seen to increase with the addition of Environmental Baseline Survey (EBS) data to the Site 1, and College of Alameda data set. The Navy agrees that the summary statistics change with the addition of the EBS data to the Site 1, and College of Alameda data set (called "data set 1"). However, upon evaluation, it was seen that the mean and upper 95 percent confidence limit of the mean (95 UCL) concentrations decreased, not increased, with this addition. A comparison of Table 1 (which contains the summary statistics for data set 1) to Table 2 (the EBS samples only) and Table 3 (the combined data set 1/ EBS samples) from the February 22, 1996 letter shows that the EBS samples are within the lower range of concentrations detected in data set 1. The summary statistics are lowered by the addition of EBS samples to data set 1 due to the fact that concentrations reported in the EBS samples are within the lower range of detected concentrations and the increase in sample size decreases the standard deviation of the combined data set, furthering lowering the 95 UCL concentration.

DTSC clarified that the more important part of this comment was that combinability of the three data sets must be examined. The Navy stated that the three data sets are geologically indistinguishable and that the Navy would continues to review the combinability of the data set. DTSC acknowledged the geological similarity.

The combinability of the data sets, to the extent that they have been evaluated to date, is discussed in the following paragraphs.

Three data sets were evaluated for use as potential background data at NAS Alameda. These data sets were previously presented, but are included again in this letter for ease of review. The three data sets have been termed "Site 1" (reflecting data from the Site 1 area of NAS Alameda); the College of Alameda data set (collected from the near-by College of Alameda and used at the Alameda Annex as background data); and the Environmental Baseline Survey (EBS) data set.

The complete EBS data set was collected across the entire installation, although samples included here are a subset of the larger data set. These samples were selected using the following criteria: (1) they contained detections of metals and polycyclic aromatic hydrocarbons (PAHs) only; (2) they were collected and analyzed using Contract Laboratory Program (CLP) methodology: and (3) and fill history, site history, and aerial extent of the sampling. Fill and site history were used to guide selection of samples from the Site 1 and EBS database to avoid inclusion of samples from areas that could contain site-related metals contamination. The EBS samples included are outside the boundaries of the Installation Restoration Program (IRP) which are the focus of the Remedial Investigation (RI) at NAS Alameda; neither the EBS nor Site 1 data include outfall or landfill areas. The samples were selected to ensure that any differences in soil type due to source of fill would be distinguishable. No geological differences were observed, and the samples selected cover much of the base.

Tables 1, 2, and 3 in this letter summarize each data set. The sample quantitation limits (SQLs), frequencies of detection, range of concentrations, and descriptive summary statistics are presented for each chemical in each data set. Descriptive summary statistics were calculated using one-half the SQL for non-detected results. The probability density functions (PDFs) of each chemical were determined using only the detected sampling results to avoid skewing the PDFs toward the detection limits. The PDFs are indicated in the footnotes of each table. The data summarized in Tables 1 and 2 were presented in the January 30, 1996 meeting with the US. EPA, DTSC and the Navy as being the basis for the potential background data set. As shown in these tables, the concentration ranges of the three data sets overlap for most chemicals, with the College of Alameda tending to have inorganic chemical concentrations toward the upper ranges and EBS data tending to be on the lower end of the range. The results of combining the three data sets and the descriptive statistics are shown in Table 4.

The three data sets were analyzed to determine whether combining them was statistically justifiable. Although the three data sets are not geologically distinct, their origins are unknown. Therefore, while they may appear similar geologically, the concentrations of inorganic chemicals in the fill soil from different areas may not be the same. Because almost all soils at NAS Alameda under consideration in the RI are fill soil from unknown and potentially different sources, it is likely that the Site 1, College of Alameda, and EBS samples could vary slightly for particular chemicals. This same issue will occur in the RI data set due to the nature of the fill soil. If the soils do not appear similar after examining the chemical concentrations, they should not be combined.

To determine whether the three data sets could be combined, a Kruskal-Wallis test was performed. According to Gilbert (1987), "The Kruskal-Wallis test is an extension of the Wilcoxon rank sum test from two to k independent data sets. These data sets need not be drawn from underlying distributions that are normal or even symmetric, but the k distributions are assumed to be identical in shape." This test can accommodate non-detect results and is not dependent on probability density functions.

Four chemicals were arbitrarily selected for the Kruskal-Wallis test: arsenic, beryllium, chromium, and manganese. Arsenic and beryllium had frequencies of detection less than 100 percent, while chromium and manganese had full frequencies of detection. Non-detect results were included in this test. The Kruskal-Wallis test indicated that at least one data set was significantly different from the others for each chemical at the alpha = 0.05 level of significance. Because the results of the Kruskal-Wallis test do not indicate which data set is different, a Wilcoxon rank sum test was applied to the data sets in pairs to determine which data set(s) were significantly different from the others.

First, the Site 1 data was compared to the College of Alameda data for the four chemicals. The results of the Wilcoxon rank sum test indicated that the Site 1 and College of Alameda data were not significantly different at the alpha = 0.05 level of significance for arsenic and beryllium (nondetects were included in this test). For chromium and manganese, the Site 1 data appeared to have lower concentrations. Examination of the data showed this to be correct, but the magnitude of these differences may not be important. For example, chromium concentrations in the Site 1 data ranged *from 25 to 66.7 milligrams per kilogram (mg/kg) and ranged from 15.8 to 314 mg/kg in the College of Alameda data. Removing the highest concentration (314 mg/kg) from the College of Alameda data set, the range is 15.8 to 92.6 mg/kg. Most concentrations in both data sets are between 30 and 70 mg/kg. In general, the difference indicated by the Wilcoxon rank sum test may be due to small differences (less than 10 mg/kg) between the two data sets. For manganese, comparison of the Site 1 data to the College of Alameda data had similar results. In the Site 1 data set, half of the reported detections were between 88 and 169 mg/kg, and the remainder were between 170 and 320 mg/kg. Two-thirds of the College of Alameda data reported detections between 170 and 320 mg/kg, and the remainder from 337 mg/kg to 1,440 mg/kg. If the highest concentration is removed (1,440 mg/kg), the range is up to 606 mg/kg.*

The results of the Wilcoxon rank sum test indicate that the Site 1 and College of Alameda data are comparable.

The EBS data were then compared to the Site 1 and College of Alameda data sets for arsenic, beryllium, chromium, and manganese. In all cases, the EBS data appeared to have lower analyte concentrations than either the Site 1 or College of Alameda data when both detected and non-detected values were included in the Wilcoxon rank sum test. When nondetects were excluded, the Site 1 data and EBS data were not significantly different for beryllium but remained different for arsenic. (Chromium and manganese had 100 percent frequencies of detection and were not retested.) EBS data were significantly different from College of Alameda data for all analytes regardless of inclusion or exclusion of non-detect results.

The apparent differences between the EBS data and both the Site 1 and College of Alameda data cannot be observed when these data are combined and plotted as shown in Figure 1a through 1d. These graphs include only detected concentrations from each data set. The coefficient of variation (CV) is also low for the combined data set. The CV is lower for the combined data set than for each data set separately due to a decrease in the standard deviations of the data set and an increase in sample size. This can be seen in Tables 1 through 4.

Due to the decrease in variation from combining the data sets and the inability to graphically reproduce the results of the Wilcoxon Rank Sum test, the EBS data were furthered investigated. The EBS data set, in addition to having the lowest concentrations for inorganic analytes, had the highest detection limits and lowest frequencies of detection for PAHs. This is an unusual situation because matrix interference (the reason for elevated detection limits) is usually caused by high concentrations of other chemicals in a sample. However, the EBS samples selected for inclusion were specifically chosen because they contained only metals and PAHs. There appears to be no reason for the high detection limits for PAHs. Additionally, anomalous inorganic chemical results were also observed in at least one sample in the EBS data; for example, magnesium and manganese were reported as nondetected with detection limits of 7.3 mg/kg and 0.27 mg/kg, respectively. All other EBS samples included as proposed background samples had concentration ranges of 1,610 mg/kg to 5,030 mg/kg for magnesium and 71.7 to 320 mg/kg for manganese. There was no reason why these two analytes, which are common soil components at easily detected concentrations, were reported as nondetected.

To verify that the EBS data were of sufficient quality and that the detection limits could be explained, the EBS samples were re-queried and are being reviewed by chemists.

The second specific comment stated that the data summary provided for the polycyclic aromatic hydrocarbons was not discussed in the Navy deliverable. Further concern was expressed regarding low frequency of detection, high detection limits and high upper bound estimates. It was clarified that the intent of this comment was to request from the Navy a discussion of which concentration will be used as representative of ambient polycyclic aromatic hydrocarbons (PAHs) at NAS Alameda. The PAH summary statistics had been provided for completeness, as these chemicals had been detected in the data selected as potential background data. No conclusions had been drawn regarding the PAH concentrations because it seems that at least one data set (the EBS data set) had elevated detection limits. Our February 22, 1996 was intended to share data with the agencies to begin a joint analysis now in progress. The detection limits are being researched at this time to determine the cause of the elevation. The PAH concentrations will require further investigation. However, if high detection limits (and, therefore, low frequency of detection) cause the upper-bound estimates to exceed the maximum detected concentration, the upper-bound estimates calculated using one-half the sample quantitation limit for non-detect results are not appropriate approximations of the concentration distributions. Solutions to this complication could include using only detections for estimation of PAH descriptive statistics; using the maximum detected value instead of the upper-bound estimate (as described in the comment); or use of more sophisticated statistical programs to better approximate the data distribution form censored data (i.e., the UNCENSOR program described in the Statistical Methodology Technical Memorandum. Statistical tests can be used for data sets containing less than 50 percent detection frequency, including the Gehan test and the Peto-Prentice tests. These could be used to test the differences in means between the site PAH data and ambient PAH levels if low frequency of detection is a problem.

The third comment regarded the calculation of power associated with the size of the combined background data set. It was requested that the statistical test used as a basis for the estimates be specified. Power was estimated by first calculating a critical region of what was assumed to be the established background values for the Island of Alameda fill soils (the College of Alameda data). The critical region was calculated according to the equations shown of Attachment A. This is the power of the test defined as "probability of rejecting the tested hypothesis when it is false." The probability that a type II error will occur (that the tested hypothesis will be accepted when it is false) is symbolized by beta (B) and is equal to 1-power. The equation may also be expressed as power = 1-B. To minimize B (and increase power) without changing the probability of a Type I error (false positive) the sample size must be increased. Therefore, while power may be defined as the "power of the test," it is dependent on three things as shown in the equation in Attachment A: a specified Type 1 error rate; the sample size; and the variance of the data. For both data set 1 (Site 1 and College of Alameda) and the combined data set (College of Alameda, Site 1, and EBS samples) the power was calculated by setting the Type I error rate to 0.05 and calculating beta using mean and standard deviation of the data set. The College of Alameda was used as the standard against which the other data sets were compared to determine power. All non-detects were set equal to one-half the sample quantitation limit. DTSC clarified that they were requesting a terminology clarification and were not disagreeing with the results. The information regarding power was not requested by the agencies.

The final specific comment requested a re-graphing of the comprehensive RI data set for arsenic, beryllium, cadmium, mercury and lead using log transformed data. These graphs were provided to DTSC on March 5, 1996. A separate facsimile transmission of the graphs was provided to EPA in April.

References:

R.O. Gilbert. 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold. New York.

Attachment A: From Statistics with Applications to the Biological and Health Sciences, Second Edition. By R.D. Remington and M.A. Schork. Prentice-Hall, Inc. New Jersey. 1985.

To determine the power of the test of $H: \mu = \mu_0$ against the alternative hypothesis $H_a: \mu = \mu_1$ we must find the probability of rejecting H when in fact H_a is true. But we reject H whenever

$$\frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} \leqq z_{\alpha/2} \quad \text{or} \quad \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} \geqq z_{1-(\alpha/2)}$$

When H_a is true, then μ_1 is the true population mean and the quantity $(\bar{x} - \mu_0)/(\sigma/\sqrt{n})$ will not follow the standard normal distribution. In this case $(\bar{x} - \mu_1)/(\sigma/\sqrt{n})$ will be standard normal.

Example 2

In Example 1, in which we were testing the hypothesis that mean chest circumference of a population of newborn girls is 13.0 in. when σ is 0.7 in., assuming that chest circumference is normally distributed, find the power of the test against the alternative hypothesis that $\mu = \mu_1 = 12.8$, for random samples of size 25 and $\alpha = 0.05$.

The critical region here consists of values:

$$\frac{\bar{x} - 13.0}{0.14} \leqq -1.96 \quad \text{or} \quad \frac{\bar{x} - 13.0}{0.14} \geqq 1.96$$

But multiplying both inequalities through by 0.14 and adding 13.0 we find that the critical region can be expressed as[4]

$$\bar{x} \leqq 13.0 - (1.96)(0.14) = 12.73 \quad \text{or} \quad \bar{x} \geqq 13.0 + (1.96)(0.14) = 13.27$$

Now we must find the probability of this event given that the alternative hypothesis is true, that is, $\mu = 12.8$; this probability will be the power. If $\mu = 12.8$, then $\bar{x}$ is normal with mean 12.8 and standard deviation $\sigma/\sqrt{n} = 0.7/\sqrt{25} = 0.14$, and $z = (\bar{x} - 12.8)/0.14$ will be a standard normal variable. Therefore, we find using the notation for conditional probability presented in Section 3-10 and noting that the two events connected by "or" are mutually exclusive

$$\begin{aligned}
\text{power} &= P(\text{rejecting hypothesis } \mu = 13.0 \mid \mu = 12.8) \\
&= P(\bar{x} \leqq 12.73 \quad \text{or} \quad \bar{x} \geqq 13.27 \mid \mu = 12.8) \\
&= P\left(z \leqq \frac{12.73 - 12.8}{0.14} \quad \text{or} \quad z \geqq \frac{13.27 - 12.8}{0.14}\right) \\
&= P(z \leqq -0.50 \quad \text{or} \quad z \geqq 3.36) \\
&= P(z \leqq -0.50) + P(z \geqq 3.36)
\end{aligned}$$

TABLE 1

NAS ALAMEDA "SITE 1"
POTENTIAL BACKGROUND DATA FOR NAS ALAMEDA
DATA SUMMARY

Chemical	Sample Quantitation Limit	Frequency of Detection	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	95 Percent Upper Confidence Limit Concentration	Coefficient of Variation
Inorganics (mg/kg)								
Aluminum(1)	NA	19/19	3830	19000	7687	3675	9149	0.48
Antimony(3)	0.46 - 11	1/19	3.5	3.5	3.5	1.0	3.9	0.29
Arsenic(1)	10	18/19	1.3	33	10.5	9.4	14.2	0.90
Barium(1)	21	17/19	21	74	40.8	19.1	48.4	0.47
Beryllium(3)	0.527 - 1.1	4/19	0.061	1.28	0.54	0.22	0.60	0.41
Cadmium(1)	0.381 - 1.19	5/19	0.68	1.7	0.65	0.36	0.8	0.55
Calcium(1)	NA	19/19	2100	97000	8593	21451	17126.8	2.5
Chromium(1)	NA	19/19	25	66.7	35.8	9.4	39.5	0.26
Cobalt(1)	3.96 - 7.6	10/19	3.8	9.6	4.9	2.7	6.0	0.55
Copper(1)	NA	19/19	3.79	49	18.6	14.2	24.2	0.76
Iron(1)	NA	19/19	7560	27900	12884.2	5384.9	15026.5	0.42
Lead(2)	NA	19/19	2.48	752	68.1	170.9	136.1	0.49
Magnesium(1)	NA	19/19	1600	8800	3256	1902	4013	5.8
Manganese(1)	NA	19/19	88	320	172	77.9	203	0.45
Mercury(1)	0.063 - 0.15	2/8	0.076	0.644	0.13	0.21	0.2	1.6
Nickel(1)	NA	19/19	22.2	53.5	32.2	9.94	36.2	0.31
Potassium(1)	NA	19/19	540	2480	1081	462	1265	0.43

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Enclosure (1)

TABLE 1 (Continued)

NAS ALAMEDA "SITE 1"
POTENTIAL BACKGROUND DATA FOR NAS ALAMEDA
DATA SUMMARY

Chemical	Sample Quantitation Limit	Frequency of Detection	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	95 Percent Upper Confidence Limit Concentration	Coefficient of Variation
Inorganics (mg/kg) (Continued)								
Sodium(1)	125 - 520	7/19	235	1360	427	365	572	0.85
Titanium(1)	NA	11/11	280	663	484.6	102.9	525.5	0.21
Vanadium(1)	NA	19/19	19	51.1	29.2	9.9	33.1	0.34
Zinc(1)	NA	19/19	17.2	130	48.4	33.6	61.8	0.69
Polycyclic Aromatic Hydrocarbons (μg/kg)								
Chrysene(3)	110 - 1400	1/27	22	22	275.3	158.8	327.4	0.58
Fluoranthene(3)	92 - 1400	2/27	30	350	283.0	157.7	334.8	0.56
Indeno(1,2,3-cd)pyrene(3)	170 - 1400	1/27	21	21	284.7	146.0	332.6	0.51
Phenanthrene(3)	85 - 1400	2/27	120	240	286.3	147.8	334.8	0.52
Pyrene(3)	85 - 1400	3/27	33	590	295.5	163.6	349.2	0.55

Notes:

(1) Data normally distributed
(2) Data lognormally distributed. Calculated coefficient of variation for natural logarithm-transformed data.
(3) Too few detections to determine distribution
NA Not applicable
mg/kg milligrams per kilogram
μg/kg micrograms per kilogram

TABLE 2

COLLEGE OF ALAMEDA
POTENTIAL BACKGROUND DATA FOR NAS ALAMEDA
DATA SUMMARY

Chemical	Sample Quantitation Limit	Frequency of Detection	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	95 Percent Upper Confidence Limit Concentration	Coefficient of Variation
Inorganic Chemicals (mg/kg)								
Aluminum(2)	NA	15/15	6700	60100	17985	12422	23633	0.05
Antimony(2)	NA	15/15	0.51	5.6	1.3	1.2	1.85	12.2
Arsenic(2)	NA	15/15	3.5	25.6	7.3	5.3	9.7	0.26
Barium(2)	NA	15/15	34.4	400	115.5	80.6	152.2	0.11
Beryllium(2)	0.24-0.39	13/15	0.32	2.1	0.58	0.44	0.78	0.82
Cadmium(1)	0.06-0.45	6/15	0.08	0.39	0.12	0.11	0.17	0.92
Calcium(2)	NA	15/15	3090	22600	7019	4694	9153	0.06
Chromium(2)	NA	15/15	15.8	314	74.1	67.6	104.8	0.16
Cobalt(2)	NA	15/15	5.8	64.6	14.7	14.5	21.3	0.24
Copper(2)	NA	15/15	14	238	61.8	59.1	88.7	0.19
Iron(2)	NA	15/15	14200	119000	33966.7	24214.6	44976.7	0.05
Lead(2)	NA	15/15	12.1	168	37.9	36.5	54.4	0.18
Magnesium(2)	NA	15/15	3930	37800	9541.3	7816.4	13095.3	0.06
Manganese(2)	NA	15/15	172	1440	388.9	311.4	530.45	0.10
Mercury(1)	NA	15/15	0.131	0.989	0.49	0.26	0.61	0.53
Molybdenum(3)	0.15-1.3	3/15	0.33	0.46	0.25	0.21	0.35	0.84
Nickel(2)	NA	15/15	18.2	335	76.8	71.8	109.48	0.15
Potassium(1)	NA	15/15	1090	8850	3061.3	2022.4	3980.9	0.66
Silver(3)	0.06-0.45	2/15	0.22	0.28	0.16	0.13	0.21	0.81
Sodium(2)	NA	15/15	53.6	6420	1105.5	1887	1963.46	0.24
Vanadium(2)	NA	15/15	23.5	236	57.1	49.9	79.76	0.14
Zinc(2)	NA	15/15	40.8	417	118.3	87.6	158.16	0.12

TABLE 2 (Continued)

COLLEGE OF ALAMEDA
POTENTIAL BACKGROUND DATA FOR NAS ALAMEDA
DATA SUMMARY

Chemical	Sample Quantitation Limit	Frequency of Detection	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	95 Percent Upper Confidence Limit Concentration	Coefficient of Variation
Polycyclic Aromatic Hydrocarbons (μg/kg)								
Acenaphthene(3)	360-2600	1/14	130	130	464.3	426.7	720	0.92
Acenapthylene(3)	360-2600	1/14	1,800	1,800	737.1	699.9	1,156.5	0.95
Anthracene(3)	360-2600	1/14	2,400	2,400	626.4	644.6	1,013	1.0
Benzo(a)anthracene(2)	360-2500	5/14	41	3,800	629.7	953.6	1,201	0.20
Benzo(a)pyrene(2)	170-2000	8/14	75	4,000	603.4	988.0	1,195	0.20
Benzo(b)fluoranthene(2)	210-2000	8/14	92	4,500	689.6	1105.0	1,352	0.20
Benzo(g,h,i)perylene(2)	210-2600	6/14	52	2,100	544.4	584.5	895	0.20
Benzo(k)fluoranthene(2)	62-2000	8/14	25	1,600	398.7	473.9	683	0.28
Carbazole(3)	360-2600	1/14	1,000	1,000	526.4	436.7	788	0.83
Chrysene(2)	360-2600	8/14	49	4,100	571.6	1020.5	1,183	0.21
Dibenz(a,h)anthracene(3)	360-2600	1/14	410	410	484.3	417.0	734	0.86
Fluoranthene(2)	360-1900	11/14	57	10,000	995.4	2512.3	2,501	0.26
Indeno(1,2,3-cd)pyrene(2)	140-2600	7/14	49	2,000	597.3	765.3	1,056	0.23
2-Methylnapthalene(3)	360-2600	1/14	610	610	498.6	417.6	749	0.84
Napthalene(3)	360-2600	1/14	1,300	1,300	548	465.8	827	0.85
Phenanthrene(3)	360-2600	3/14	30	14,000	1,429	3513.6	3,535	2.5
Pyrene(2)	360-370	12/14	73	11,000	1,196	2749.1	2,843	0.22

Notes:

(1) Data normally distributed
(2) Data lognormally distributed. Calculated coefficient of variation for natural logarithm-transformed data.
(3) Too few detections to determine distribution
NA Not applicable
mg/kg milligrams per kilogram
μg/kg micrograms per kilogram

TABLE 3

NAS ALAMEDA EBS SAMPLES
FOR USE AS POTENTIAL BACKGROUND DATA
DATA SUMMARY

Chemical	Sample Quantitation Limit	Frequency of Detection	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	95 Percent Upper Confidence Limit Concentration	Coefficient of Variation
Inorganic Chemicals (mg/kg)								
Aluminum(1)	NA	38/38	2820	8280	4596	1282	4946	0.28
Antimony(1)	0.45-2.9	11/38	0.56	2.6	0.65	0.53	0.79	0.82
Arsenic(1)	0.61-2.2	19/38	0.77	1.8	1.0	0.44	1.1	0.44
Barium(1)	NA	38/38	19.8	84.3	36.6	13.1	40.1	0.36
Beryllium(1)	0.15-0.2	11/38	0.19	0.42	0.16	0.11	0.19	0.69
Cadmium(1)	0.06-0.18	5/38	0.11	0.19	0.06	0.04	0.07	0.67
Calcium(1)	NA	38/38	1350	5580	2527	863	2762	0.34
Chromium(1)	NA	38/38	12.3	36.3	27.7	4.3	28.9	0.16
Cobalt(1)	5.5	37/38	2.6	6.5	4.5	0.91	4.7	0.20
Copper(1)	6.2-13.9	31/39	5	29.4	10.1	6.1	11.8	0.60
Iron(2)	NA	38/38	6120	18700	8322	2433	8986	0.03
Lead(2)	2.6	37/38	1.5	11.1	2.9	2.0	3.5	0.51
Magnesium(2)	NA	38/38	1610	5030	2326	660	2506	0.03
Manganese(4)	NA	38/38	71.7	320	102.7	45.5	115.1	0.44
Mercury(3)	0.16-0.19	1/38	0.29	0.29	0.09	0.03	0.10	0.33
Nickel(1)	NA	38/38	13.8	31.7	22.4	3.24	23.3	0.14
Potassium(1)	NA	38/38	399	870	635	127	669	0.20
Selenium(1)	0.52-1.2	5/38	0.59	0.72	0.37	0.13	0.41	0.35
Sodium(2)	4.5-136	30/38	59.3	518	142.7	112	173.2	0.15
Thallium(1)	NA	38/38	1.1	5.0	2.1	0.71	2.3	0.34
Titanium(1)	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium(1)	NA	38/38	13	26	18.7	2.7	19.4	0.14
Zinc(4)	NA	38/38	15.7	198	27.0	28.8	34.9	1.1

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TABLE 3 (Continued)

NAS ALAMEDA EBS SAMPLES
FOR USE AS POTENTIAL BACKGROUND DATA
DATA SUMMARY

Chemical	Sample Quantitation Limit	Frequency of Detection	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	95 Percent Upper Confidence Limit Concentration	Coefficient of Variation
Polycyclic Aromatic Hydrocarbons (μg/kg)								
Acenaphthene(3)	350-120000	1/29	24	24	10,043	20023.5	17,795	2.0
Anthracene(3)	350-120000	2/29	1100	5,800	9,477.4	20024.4	17,229	2.1
Benzo(a)anthracene(3)	350-120000	1/29	37	37	10,044.2	17660.6	17,795	1.8
Benzo(a)pyrene(3)	350-120000	3/29	48	590	9,870.8	20083.5	17,645	2.0
Benzo(b)fluoranthene(3)	350-120000	2/29	43	60	10,040	20025.1	17,792	2.0
Benzo(g,h,i)perylene(3)	350-120000	1/29	400	400	10,056.7	20016.9	17,806	2.0
Benzo(k)fluoranthene(3)	350-120000	1/29	25	25	10,043.8	20023.3	17,795	2.0
Chrysene(3)	350-120000	3/29	21	680	9,872.4	20082.7	17,647	2.0
Fluoranthene(2)	350-120000	5/29	42	10,000	9,492.7	20048.8	17,254	0.38
Fluorene(3)	350-120000	1/29	630	630	9,684.7	20081.6	17,638	2.1
Indeno(1,2,3-cd)pyrene(3)	350-120000	1/29	58	58	10,044.9	20022.7	17,796	2.0
2-Methylnapthalene(1)	350-420	11/29	94	300,000	40,360	74927.1	69,365	1.9
Naphthalene(1)	350-420	12/29	27	180,000	22,372.7	43031.7	39,031	1.9
Phenanthrene(3)	350-120000	4/29	45	17,000	9,796	20072.7	17,567	2.0
Pyrene(2)	350-120000	6/29	36	12,000	9,572	20050.2	17,333	0.35

Notes:

(1) Data normally distributed
(2) Data lognormally distributed. Calculated coefficient of variation for natural logarithm-transformed data.
(3) Too few detections to determine distribution
(4) Data are neither normally nor lognormally distributed.
mg/kg milligrams per kilogram
μg/kg micrograms per kilogram
NA Not applicable

TABLE 4

NAS ALAMEDA COMBINED DATA SET
FOR USE AS POTENTIAL BACKGROUND DATA

Chemical	Sample Quantitation Limit	Frequency of Detection	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	95 Percent Upper Confidence Limit Concentration	Coefficient of Variation
Inorganics (mg/kg)								
Aluminum(2)	NA	72/72	2,820	60,100	8,201	7954	9764	0.069
Antimony(2)	0.45-11	27/72	0.56	5.6	1.5	1.5	1.8	25.8
Arsenic(2)	0.61-10	44/72	0.77	33	4.8	6.8	6.1	1.4
Barium(2)	21	70/72	19.8	400	53	50.3	63	0.19
Beryllium(2)	0.15-1.1	28/72	0.19	2.1	0.4	0.31	0.4	0.60
Cadmium(2)	0.06-1.19	16/72	0.08	1.7	0.2	0.32	0.3	0.52
Calcium(2)	NA	72/72	1,350	97,000	5,063	11292	7282	0.08
Chromium(2)	NA	72/72	12.3	314	39.5	36.2	46.6	0.13
Cobalt(2)	3.96-7.6	62/72	2.6	64.6	6.7	7.9	8.3	0.34
Copper(2)	0.95-13.9	65/72	3.79	238	23.1	34.7	29.9	0.35
Iron(1)	NA	72/72	6,120	119,000	14,868	15237	17847	1.0
Lead(2)	2.6	71/72	1.5	752	27.4	91.4	45.4	0.70
Magnesium(2)	NA	72/72	1,600	37,800	4,074	4677.5	4993	0.077
Manganese(2)	NA	72/72	71.7	1,440	181	187.3	217	0.12
Mercury(1)	0.063-0.19	18/61	0.076	0.989	0.19	0.22	0.24	1.2
Nickel(2)	NA	72/72	13.8	335	36.3	39.4	44.1	0.15
Potassium(2)	NA	72/72	399	8,850	1,258	1343	1522	0.095
Selenium(1)	0.23-23	5/72	0.59	0.72	1.3	2.5	1.8	1.9
Sodium(2)	57.7-540	51/72	53.6	6,420	413	960.4	602	0.20
Thallium(1)	0.3-11	38/72	1.1	5.0	2.0	1.7	2.3	0.85
Titanium(1)	NA	11/11	280	663	485	102.9	541	0.21
Vanadium(2)	NA	72/72	13	236	29	27.7	35	0.15
Zinc(2)	NA	72/72	15.7	417	52	59.7	63	0.21

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TABLE 4 (Continued)

NAS ALAMEDA COMBINED DATA SET
FOR USE AS POTENTIAL BACKGROUND DATA

Chemical	Sample Quantitation Limit	Frequency of Detection	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	95 Percent Upper Confidence Limit Concentration	Coefficient of Variation
Polycyclic Aromatic Hydrocarbons ($\mu g/kg$)								
Acenaphthene[3]	85-120,000	2/69	24	130	4,421	13,838	7,744	3.1
Acenaphthylene[3]	85-120,000	1/69	1,800	1,800	4,479	13,824	7,798	3.1
Anthracene[3]	85-120,000	3/69	1,100	5,800	4,216	13,737	7,514	3.3
Benzo(a)anthracene[2]	110-120,000	6/69	37	3,800	4,456	13,832	7,777	0.29
Benzo(a)pyrene[2]	150-120,000	12/69	24	4,000	4,379	13,842	7,702	0.29
Benzo(b)fluoranthene[2]	110-120,000	10/69	43	4,500	4,467	13,832	7,788	0.29
Benzo(g,h,i)perylene[2]	170-120,000	8/69	19	2,100	4,446	13,832	7,767	0.28
Benzo(k)fluoranthene[2]	62-120,000	9/69	25	1,600	4,409	13,841	7,733	0.31
Carbazole[3]	330-120,000	1/43	1,000	1,000	6,949	17,038	12,200	2.5
Chrysene[2]	110-120,000	12/69	21	4,100	4,370	13,845	7,695	0.30
Dibenzo(a,h)anthracene[3]	170-120,000	1/69	410	410	4,433	13,834	7,755	3.1
Fluoranthene[2]	85-120,000	18/69	30	10,000	4,300	13,778	7,608	0.33
Fluorene[3]	85-120,000	1/69	630	630	4,350	13,842	7,673	3.2
Indeno(1,2,3-cd)pyrene[2]	140-120,000	9/69	21	2,000	4,452	13,832	7,773	0.29
2-Methylnaphthalene[1]	110-2,600	12/69	94	300,000	17,171	52,435	29,761	3.1
Naphthalene[1]	85-2,600	13/69	27	180,000	9,620	29,937	16,808	3.1
Phenanthrene[2]	85-120,000	9/69	30	17,000	4,517	13,865	7,846	0.29
Pyrene[2]	85-120,000	21/69	33	12,000	4,378	13,790	7,689	0.29

Notes:

(1) Data normally distributed.
(2) Data lognormally distributed. Calculated coefficient of variation for natural logarithm-transformed data.
(3) Too few detections to determine distribution.
mg/kg milligrams per kilogram
$\mu g/kg$ micrograms per kilograms
NA Not applicable

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